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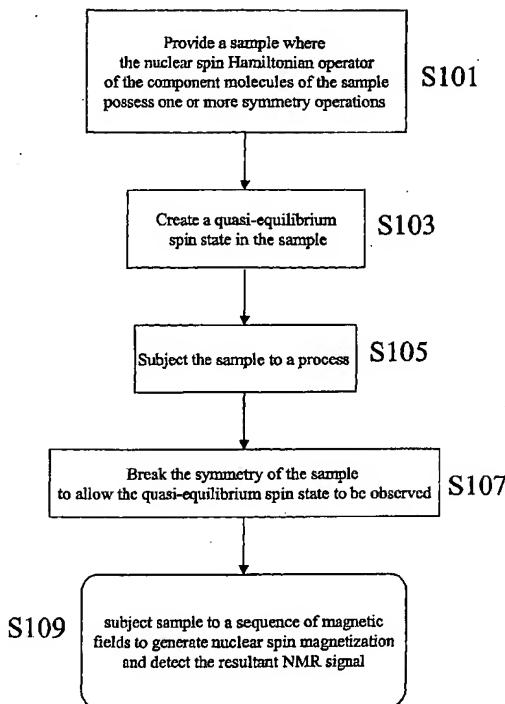
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(54) Title: NMR SPECTROSCOPY USING SPIN STATES WITH LONG LIFETIMES



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(57) Abstract: An NMR method, the method comprising: providing a sample where the nuclear spin Hamiltonian operator of the component molecules of the sample possesses one or more symmetry operations; creating a quasi equilibrium nuclear spin ensemble state in a sample, said quasi equilibrium nuclear spin ensemble state comprising at least two manifolds of spin states which transform differently under said symmetry operations of said Hamiltonian and said manifolds having different mean nuclear spin populations; allowing said quasi equilibrium nuclear spin ensemble state to remain for a time of equal to or substantially greater than  $3T_1$ , where  $T_1$  is the spin lattice relaxation time; breaking the symmetry operation of said Hamiltonian; applying a sequence of magnetic fields to generate a nuclear magnetic resonance signal from said sample; and detecting said nuclear magnetic resonance signal.



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